TY-KH15-013A

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KH15
Waterproof Pressure Transmitter

USER'S MANUAL

(KH15-J□G / K□G)

Thank you for choosing to purchase the KH15 pressure transmitter.
Before using your new transmitter, please read through this manual to familiarize yourself with its functions.

NAGANO KEIKI

2014.11

7.1

Cautions for proper and safe operation

To use this product accurately and safely, carefully read this manual and the operation manual Incorrect usage may cause malfunction and result in human injury, accidents, etc. The cautions and warnings in the document are indicated by the following:

⚠**WARNING**	**Indicates that incorrect use may result in service injury or loss of life.**

⚠**CAUTION**	**Indicates that incorrect use may result in risk of injury or property damage.**

⚠**WARNING**	**1. Do not apply more than the maximum allowable pressure.** **Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements.** **2. Do not use this product on measured objects which are corrosive to fluid or gas contacting areas.** **Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements and exposure of dangerous measured objects.** **3. Do not apply excessive weight, vibration or shock.** **Human injury or damage to surroundings may result due to explosion or breakdown of the pressure elements and exposure of dangerous measured objects.** **4. Use with the unspecified power supply may cause fire hazard or electric shock.** **5. Use with the instrument temperature range.** **Use outside the instrument temperature range may cause human injury or damage to surroundings due to explosion of breakdown of this product.** **6. Connect wiring accurately according to the wiring drawings or instructions in the operation manual.** **Incorrect wiring may result in human injury or fire hazard.** **7. Use devices with an explosion-proof construction when operating in place liable to have explosive gas.** **Danger of ignition and explosion.** **8. Where the measurement object is oxygen, use oil-proof product.** **In case of ordinary product, there is a possibility that oil remains inside the product. It may cause ignition or explosion by reaction with oxygen** **9. Perform installation carefully according to the installation instructions of the instruction manual.** **10. Do not alter this product. Also do not remodel this product by adding new functions. Contact our company for repairs.** **11. Since this product is a precision measuring instrument, keep the product as far away from noise source as possible.** **Also, remove noise from the power source by using noise filter, etc.** **Note: Inform us in advance when using this product in a way that may result in fatal or serious injury due to malfunction or incorrect operation.**

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1. Introduction

Please double-check the specifications for the model that you have received.

If specifications such as the pressure range, power source, or output are incorrect, accidents can occur. Please be sure to use a model that is appropriate for your specifications, in a location which is appropriate for your usage environment, and which has been correctly wired and installed.

2. Outline

This product is a waterproof miniature solid-state pressure transmitter equipped with a semiconductor strain gauge as its pressure detection part.

The diaphragm material used for the sensor components is SUS316L, which is highly corrosion-resistant.

The standard outputs are 4 to 20mA DC, 0 to 5V DC, and 1 to 5V DC. In addition, all circuits for this product are set up inside the terminal box, and designed to be accessible for zero point adjustment and span adjustment by removing the lid of the terminal box.

3. Model number configuration

KH15 - □ □ G

Model

J : Terminal box (small) Internal adjustment type

K : Terminal box (large) Internal adjustment type

Wetted parts material

Diaphragm : SUS316L

Fitting : SUS316L

Connecting size:

2: G1/4B K: NPT1/4

3: G3/8B L: NPT3/8

4: G1/2B M: NPT1/2

6: R1/8

7: R1/4

8: R3/8

9: R1/2

4. Specifications

Model number	KH15-☐☐G
Pressure sensor sealing type	Welding type
Pressure range *1	-0.1 to 0.5 ⇒ -0.1 to 2MPa 0 to 0.5 ⇒ 0 to 35MPa
Maximum allowable pressure *2	0.5 to 2MPa : 1.5 times high for the pressure range 3.5 to 35MPa : 1.2 times high for the pressure range
Power source	24V DC ±10% or 12V DC ±10%, 15V DC ±10% (Only power-supply voltage can be selected)
Output type	4 to 20mA DC (Load resistance: 500Ω max.) 1 to 5V DC (Load resistance: 10kΩ min.) 0 to 5V DC (Load resistance: 10kΩ min.)
Accuracy (including linearity, hysteresis, repeatability)	±0.5%F.S. or ±1.0%F.S.
Operating temperature range	-20 to 70°C (No freezing or condensation) *3
Storage temperature range	-30 to 80°C (No freezing or condensation)
Temperature characteristics	±0.1%F.S./°C (For both zero point and span)
Responsiveness	1 ms or shorter
Wetted parts material	Diaphragm : SUS316L Fitting : SUS316L
Connecting size	G1/4B, G3/8B, G1/2B, R1/8, R1/4, R3/8, R1/2, NPT1/4, NPT3/8, NPT1/2
Weight	KH15-J☐G (terminal box (small)): approx. 220 g KH15-K☐G (terminal box (large)): approx. 360 g
Case structure *4	IP67 (According to JIS C 0920)
CE marking *5	Applicable Directive: 2004/108/EC Applicable Standards: EN61326-1:2006 EN61326-2-3:2006

*1: Atmospheric pressure is transmitted to the gauge by way of a cable; consequently, in the case of pressure ranges below 1MPa, please refrain from sealing the end of the cable with tape or adhesives during the wiring process. In addition, please avoid the use of cables which are not breathable (e.g. which lack an opening down the middle).

*2: Allowable maximum pressure is the upper limit to which pressure may be temporarily increased while still allowing normal pressure to be resumed, when pressure levels return to the normal (rated) range. It is not guaranteed to have no impact on functionality in the case of repeated pressure or static pressure increases lasting 10 minutes or more.

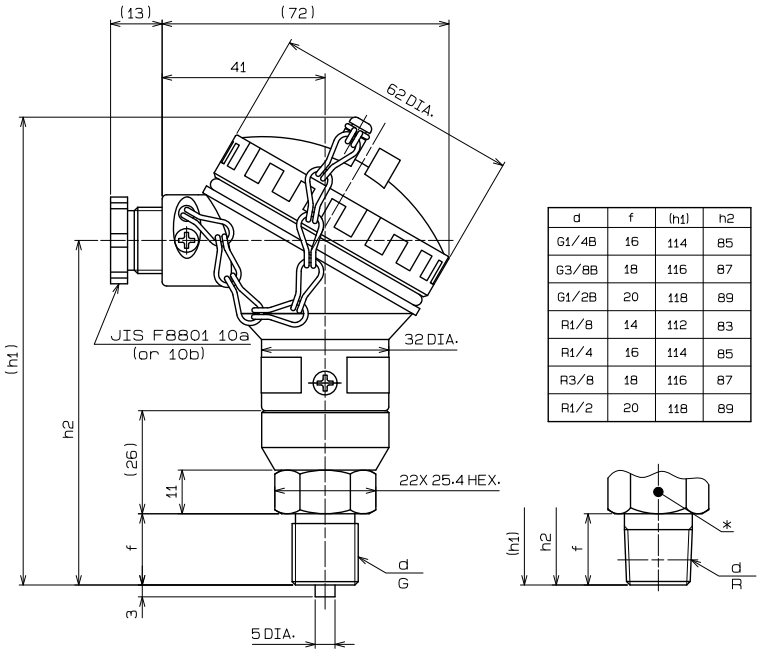
*3: If the wetted part reaches temperatures exceeding 70°C (due to steam, hot water, etc.), please be sure to install a pipe siphon or similar device to keep it below 70°C. Also, when measuring low-temperature fluids such as cold water, please employ preventive measures against condensation.

*4: The case is a waterproof construction (IP67), but please be sure to thoroughly waterproof any and all openings for wiring (cable glands [JIS F 8801]).

*5: Please connect the product before use to an indoor power grid under 30m which is protected from overvoltage caused by lightning strikes.

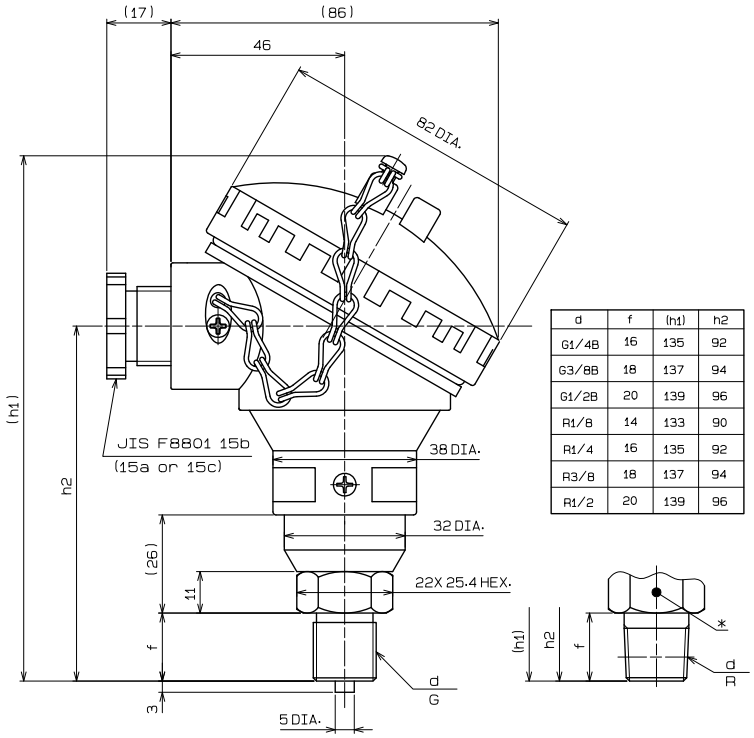
5. Outline drawings (Representative example)

KH15-J□G



d	f	(h1)	h2
G1/4B	16	114	85
G3/8B	18	116	87
G1/2B	20	118	89
R1/8	14	112	83
R1/4	16	114	85
R3/8	18	116	87
R1/2	20	118	89

KH15-K□G

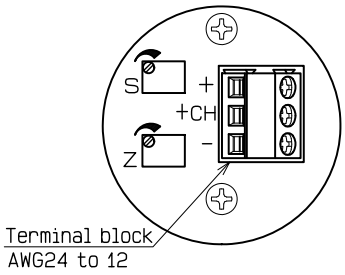
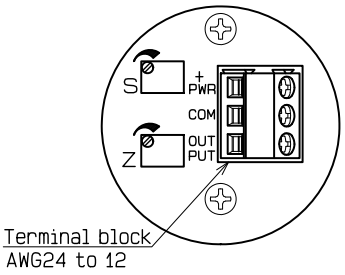
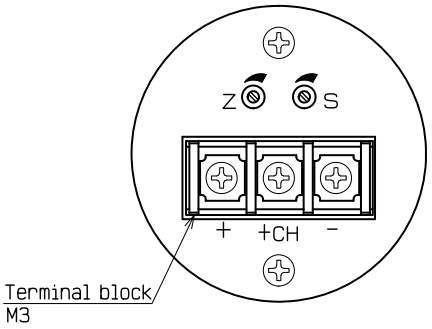
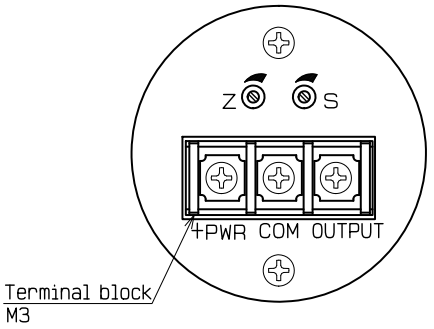


d	f	(h1)	h2
G1/4B	16	135	92
G3/8B	18	137	94
G1/2B	20	139	96
R1/8	14	133	90
R1/4	16	135	92
R3/8	18	137	94
R1/2	20	139	96

* The hexagonal fitting is inscribed with “LC”

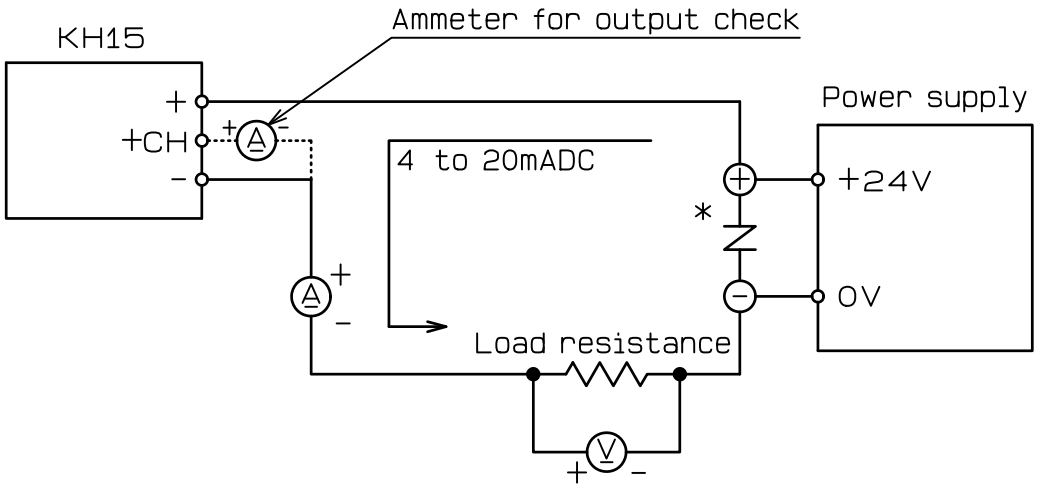
6. Wiring connection diagram and external connection

(1) Wire connection

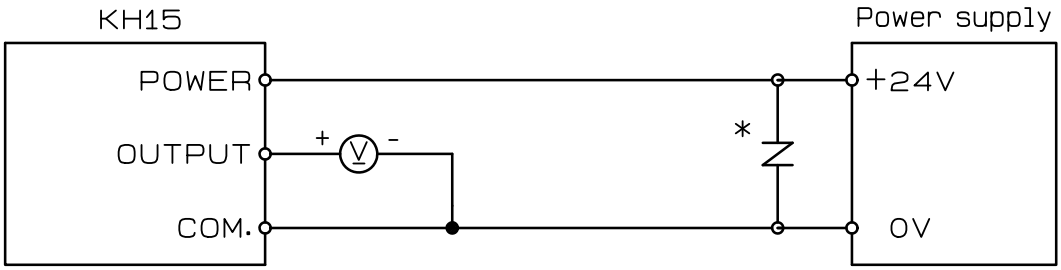
	2-wire	3-wire
KH15-J□G		
KH15-K□G		

(2) Examples of external connection

e.g. 1) 2-wire system (4 to 20mA DC)



e.g. 2) 3-wire system (1 to 5V DC, 0 to 5V DC)



* When connecting a device which may cause power surges from the same power supply, install a varistor as a countermeasure to protect KH15.

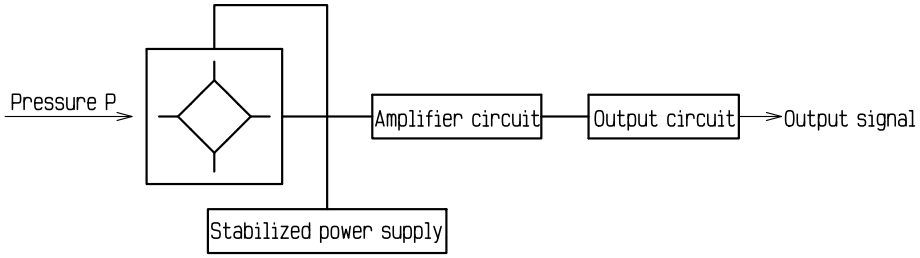
⚠CAUTION	• **Before installation, please check the rated value of the specifications for this product and select an appropriately rated power supply. After double-checking the load resistance of this product, please use adaptation equipment with internal resistance within that rated range.**

7. Operating principles

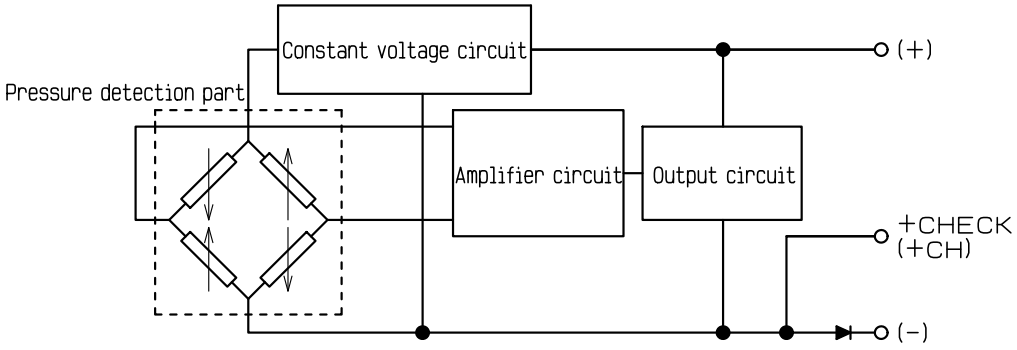
The pressure receiving part of this product is a diaphragm which converts pressure into strain. The amount of the strain is detected by the semiconductor strain gauge.

The detection circuit is the full bridge type whose four sides consist of semiconductor strain gauge. From this bridge circuit, electric signals proportional to the strain are obtained. Then by the signal conversion shown below, DC electricity or DC voltage is transmitted.

(1) Block diagram



(2) Example of a structure of the above diagram (4 to 20mA DC output)



8. Precautions for use

(1) Installation

1) When this product is connected to the pressure line, do NOT tighten the main body of the case with pipe wrench or similar.

   For installation, make sure to use hexagonal part of connection screw.

2) When installing to pressure line, do NOT install the product while the liquid is filled up in the pipe.

   Since liquid is incompressible, tightening a connecting screw may generate high pressure and instrument failure.

   When installing to the existing pressure line or in the case of replacement, drain the liquid inside the piping connection side and install the product with leaving air of about 15 to 20mm.

3) Although this product has high vibration resistance, since this product is a measuring instrument, be careful not to apply severe vibration.

4) Installation position may be vertical, front to back, side to side, or horizontal.

5) This product has protection code IP67 (JIS C 0920). However, for longer use, select a location that is not affected by direct sunlight, dump, dust, oil or water.

⚠CAUTION	**• While installing piping during installation, do not administer any strong shocks to the product such as thumping or dropping it.** **• Please maintain enough space around the product to allow for maintenance and adjustment.** **• If the wetted part reaches temperatures exceeding 70°C (due to steam, hot water, etc.), please be sure to install a pipe siphon or similar device to keep it below 70°C. Also, when measuring low-temperature fluids such as cold water, condensation may form on the detecting sensor, which can cause accidents. Please employ preventive measures against condensation.** **• Please do not insert wires, etc., into the pressure feed port. This may damage the diaphragm and prevent it from operating normally.** **• Please wrap tapered pipe threads in plumber's tape to prevent leaks.** **• If using straight pipe threads, please check for debris, dirt, and damage to the washer and seal face before installation to prevent leaks.** **• If there is a danger of surge pressure, please concurrently use a damper and joint with throttle.** **• To prevent water from entering via cables, do not orient glands upward.** **• Always avoid pulling or severely bending cables. Also, during installation, be careful not to hang the full weight of any cables from this product.**

(2) Wiring connection

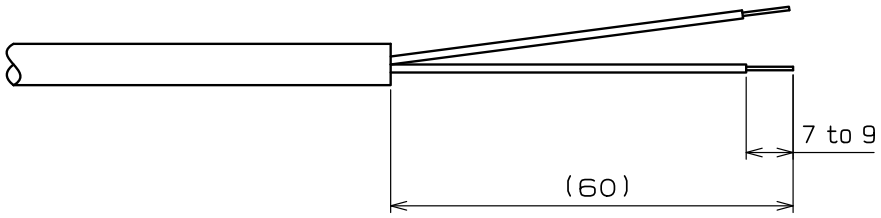
1) Please refer to the diagram below to select compatible sealed cables for use.

Model number	Connecting size		Gasket I.D. (Comp. Cable I.D.)
KH15-J☐G	G3/8	10a (standard)	7 DIA.
		10b	8 DIA.
KH15-K☐G	G1/2	15a	9 DIA.
		15b (standard)	10 DIA.
		15c	11 DIA.

2) Depending on style number, set up cable terminals according to the diagrams below.

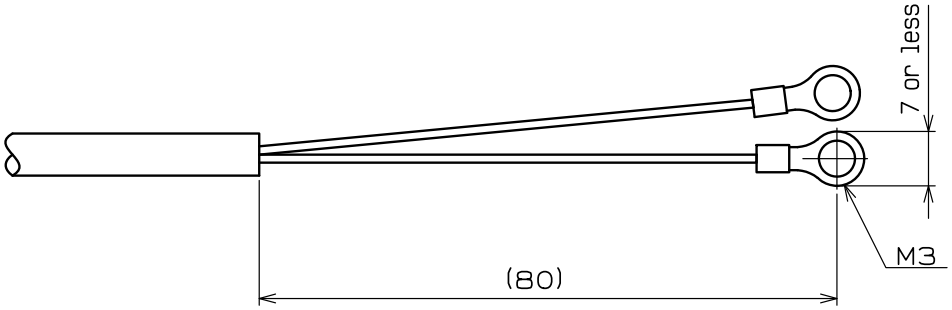
• KH15-J☐G

Leave 60mm of cable sheath and 7 to 9mm of core cladding. Shield the base of the sheath. The appropriate power cable for the Terminal block is AWG24 to 12 (0.2 to 3.3mm^2).



• KH15-K☐G

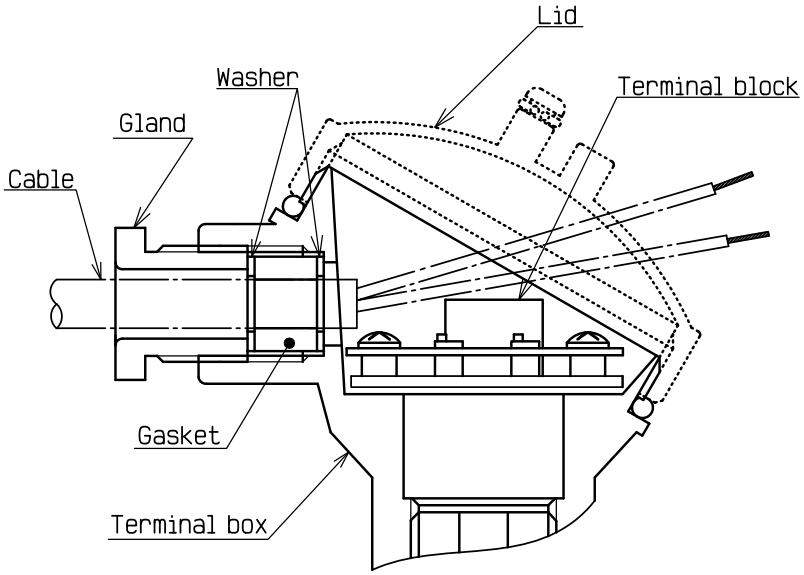
Leave 80mm of cable sheath and enough core cladding to use the M3 crimp terminals.
Attach crimp terminals to the ends of the wires. Shield the base of the sheath.



⚠CAUTION	• **Use appropriate crimp terminals for the leads.** • **Do not allow the shield to protrude past the end of the sheath.** • **Atmospheric pressure is transmitted to the gauge via the cable. Do not allow the cable to be obstructed by clamps, bushes, or extreme bending, and remember that a lengthy cable may take longer to transmit pressure.**

3) Open the lid of the terminal box, and insert the cables through the terminal and into the gasket.
(See diagram below.)

4) Tighten the gland, and seal the terminal. (See diagram below.)



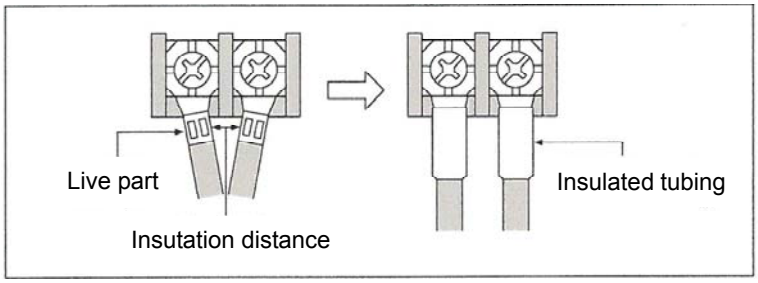
⚠CAUTION	• **Tighten gland securely to prevent water from getting in.**

5) Connect electrical lines to Terminal block.

Recommended tightening torque for KH15-J☐G is 0.4N・m

Recommended tightening torque for KH15-K☐G is 0.5N・m

⚠CAUTION	• **If using naked crimp terminals, maintain insulation distance with insulated tubing to avoid exposing the live parts, in order to avoid electrical shocks, short circuits, etc. (See diagram below.)**



• **Do not attempt to hook up this product if any part of it is wet or in contact with water. Allowing water to enter the product can cause accidents.**

• **Be careful not to misplace any parts while hooking up the product.**

6) Tighten the lid of the terminal box, and seal the terminal box.

(3) Waterproofing wire entry points

This product is kept waterproof by using cables with an appropriate external diameter to match the size of the glands. Tightening the lid of the terminal box and inserting wires at the correct points also affect the waterproofing, so please exercise caution. Furthermore, if using off-the-shelf glands and cable conduits rather than the enclosed glands, it is the customer's responsibility to double-check the waterproofing.

⚠CAUTION	• **The IP67 protection code is guaranteed only if the product has been installed correctly.**

(4) Cautions for transportation and control

1) Cautions for transportation

Since this product is a precision measuring instrument, pay enough attention when transporting the product. Drop or shock may cause a fatal damage.

2) Cautions for unpacking

Before unpacking, check the appearance of the package.

When unpacking, handle the package with care.

When bringing out the product from the packaging box, be careful not to drop the product.

After unpacking, check if there is any damage on the external surface and the product type is correct as it is ordered.

If any abnormality is found, make contact with the distributor or NKS sales office.

(5) Cautions for storage

⚠CAUTION	**To avoid failures or damages, do not store this product in the places where:** • **exposed to water.** • **susceptible to adverse effects due to air pressure, temperature, humidity, ventilation, sunlight, particles, salt or sulfur in the air.** • **exposed to inclination, vibration or shock. (including during transportation)** • **exposed to chemicals (chemicals' storage area) or gas.** • **exposed to direct sunlight or high temperature in a car, etc.**

9. Operation

Before powering on, double-check to make sure all wires have been correctly connected. Also, double-check the voltage rating and amperage rating of the power supply and the internal resistance of the external adaptation equipment, to be sure they are within the rated range of this product's load resistance.

Begin running properly after powering on, a 5-minute warm-up, and zero point adjustment in stable condition.

⚠CAUTION	**Observe the following precautions while operating:** **• Avoid the application of pressure ratings above those on this product's faceplate.** **• Do not adjust the wiring while this product is powered on, as this may damage this product and/or cause an electric shock. All wiring should be connected according to the wiring diagrams.**

10. Maintenance and adjustment

(1) Maintenance

This product will age at a rate proportional to its conditions of use. Please conduct a routine inspection at least once every 6 months and recalibrate the device as necessary.

Also, please recalibrate the device using a set method or recalibration mechanism.

The following is a routine inspection checklist for your reference and use.

<Routine Inspection Checklist>

- Appearance. (for scratches, cracks, warping, corrosion, etc.)
- Corrosion status of pressure inlet.
- Insulation resistance between each terminal and the case. (100MΩ or more at 50V DC)
- Check for leakage and re-tightening of connecting screw.
- Output check by a reference pressure gauge.

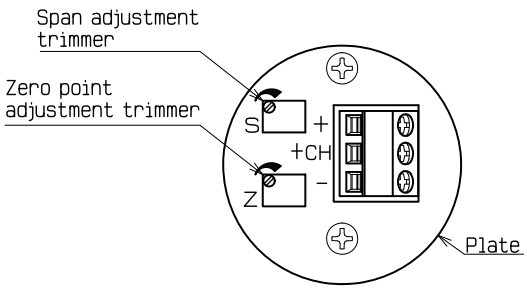
For power output, a check terminal (+CH) is included & you can detach the wiring for easy inspection.
Please use an ammeter with an internal resistance of under 10Ω for this inspection.

⚠CAUTION	**• Avoid electrostatic-charge.** **• When cleaning this instrument, use a soft damp cloth. Do NOT use thinner or benzines which cause deterioration and failure.**

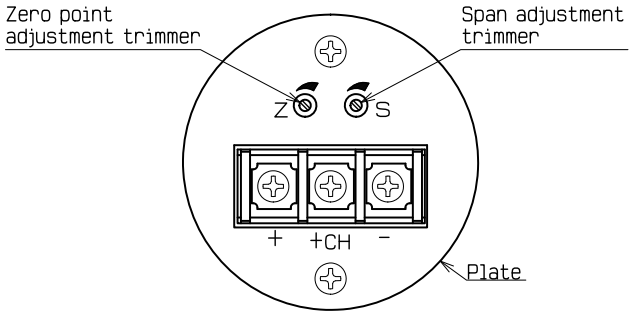
(2) Adjustment

Power adjustment may be conducted on this product by removing the lid of the terminal box.

Removing the terminal box lid will reveal a plate, as shown below. The locations marked Z and S are the zero point adjustment and span adjustment trimmers, respectively.



Current output for KH15-J☐G



Current output for KH15-K☐G

⚠CAUTION	**• Do not attempt adjustments while the product is wet. Allowing water to enter the product can cause accidents.** **• Please make adjustments after the product has been powered on and warmed up for 5 minutes.** **• Avoid putting an excessive load on the trimmers. This may damage (the circuits of) the trimmers.** **• Be extremely careful not to cause a short circuit with your screwdriver. (Use of a plastic or ceramic screwdriver is recommended.)** **• Use a pressure reference or measuring device with good traceability for adjustments.**

1) Zero point adjustment

Zero point adjustment is performed by rotating zero point adjustment trimmer with slotted screwdriver. However, the adjustment method differs between positive pressure range and compound pressure range as follows:

<Positive pressure range>

Adjust the output in air-ventilated (unpressurized) status to 4mA DC for current output, 1V DC or 0V DC for voltage output.

<Compound pressure range>

Output value in air-ventilated status is calculated according to the following formula.

• In case of current output (4 to 20mA DC)

[output mA in atmosphere release state]

= ([16mA] / ([Upper limit output in range (MPa)] – [0.1MPa])) x 0.1 + [4mA]

e.g.) 0.5MPa, Compound pressure range: 6.67mA,

1.0MPa, Compound pressure range: 5.45mA

• In case of voltage output (1 to 5V DC)
[output V in atmosphere release state]
= ([4V] / ([Upper limit output in range (MPa)] - [-0.1MPa])) x 0.1 + [1V]
e.g.) 0.5MPa, Compound pressure range: 1.667V,
1.0MPa, Compound pressure range: 1.364V

• In case of voltage output (0 to 5V DC)
[output V in atmosphere release state]
= ([5V] / ([Upper limit output in range (MPa)] - [-0.1MPa])) x 0.1 + [0V]
e.g.) 0.5MPa, Compound pressure range: 0.833V,
1.0MPa, Compound pressure range: 0.454V

⚠CAUTION	**•Do not rotate span adjustment trimmer (“S”) during zero point adjustment.**

2) Span adjustment

Except under special circumstances, please refer all span adjustment to our company.
Do not attempt span adjustment without a pressure reference device.
When attempting span adjustment with a pressure reference device, please follow the instructions below. Also, be careful of reversed output and alteration to the output values of compound gauges.

‹1› Adjust zero output, as described in “1) Zero point adjustment”.
‹2› In addition to the upper limit of the pressure range, use the span adjustment trimmer to adjust the span output with the current output to 20mA DC and the voltage output to 5V DC (or the span value).
‹3› Continue to repeat and alternate ‹1› and ‹2› to adjust the zero and span.

⚠CAUTION	**• Do not change zero point adjustment while rotating span adjustment trimmer (“S”).** **• Avoid the application of pressure ranges above those on this product’s faceplate.**

(3) Countermeasures against noise
Noise problems are complicated, and often difficult to solve theoretically.
Countermeasures are mostly incomplete.
If measured values fluctuate from time to time or differ from the actual pressure value, they may be affected by noise.
If noise is overlapped on the power supply lines, find out where the noise comes from, and provide appropriate measures at the source of noise.
If the noise is constant, use of a noise filter is effective.
It is also important to use other power lines that are free from noise.
Noise may be introduced to signal lines through external induction. It is necessary to provide suitable measures, such as moving the noise source to a remote place, using magnetic or antistatic shield.
These countermeasures also apply to surge.

11. Warranty

If the delivered product is determined to be non-compliant due to "defects in manufacture or design" within the warranty period (1 year from delivery to the customer), Nagano Keiki will repair the product or exchange it for a compliant product at no cost.

Obvious traces of misuse, including deformation of parts, wear, or burnout, shall exempt the device from its warranty, regardless of customer’s awareness of improper handling.

(1) If the delivered product is dismantled, modified, has any parts replaced, or features added by the customer or a third party besides us.

(2) If the instructions detailed in this manual or the catalog are not followed.

(3) Deterioration from use, natural disasters, fire, or other force majeure.

(4) Secondary damage caused by product incompatibility, including those items listed above.

Obvious traces of misuse, including deformation of parts, wear, or burnout, shall exempt the device from its warranty, regardless of customer’s awareness of improper handling.

12. Others

This manual is not intended to cover all details of the equipment.

Nor is it intended to cover all details relating to installation and maintenance.

If you require a more detailed explanation, or the device does not adequately serve your company’s intentions, please inquire with us.

Some of the information in this instruction booklet may change without notice due to revisions, etc.

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